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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 004860.P2452 Total Pages

First Named Inventor or Application Identifier Stephen P. Zadesky, et al.

Express Mail Label No. EL431888635US

ADDRESS TO: **Assistant Commissioner for Patents**
Box Patent Application
Washington, D. C. 20231

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. X Specification (Total Pages 14 + 1 Cover Page)
(preferred arrangement set forth below)
- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claims
- Abstract of the Disclosure

3. X Drawings(s) (35 USC 113) (Total Sheets 2)

4. X Oath or Declaration (Total Pages 4) (Signed)

a. X Newly Executed (Original or Copy)

b. ___ Copy from a Prior Application (37 CFR 1.63(d))
(for Continuation/Divisional with Box 17 completed) **(Note Box 5 below)**

i. ___ DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

5. ____ Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ____ Microfiche Computer Program (Appendix)

7. _____ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
a. ____ Computer Readable Copy
b. ____ Paper Copy (identical to computer copy)
c. ____ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. _____ Assignment Papers (cover sheet & documents(s))
9. _____ a. 37 CFR 3.73(b) Statement (where there is an assignee)
_____ b. Power of Attorney
10. _____ English Translation Document (if applicable)
11. _____ a. Information Disclosure Statement (IDS)/PTO-1449
_____ b. Copies of IDS Citations
12. _____ Preliminary Amendment
13. X Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. _____ a. Small Entity Statement(s)
b. Statement filed in prior application, Status still proper and desired
15. _____ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. X Other: Express Mail Certificate of Mailing

17. **If a CONTINUING APPLICATION,** check appropriate box and supply the requisite information:
____ Continuation ____ Divisional ____ Continuation-in-part (CIP)
of prior application No: _

18. **Correspondence Address**
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Sheena Hicks
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5-31-2000
(Date signed)

Serial/Patent No.: *** Filing/Issue Date: ***
Client: Apple Computer, Inc.
Title: METHOD OF FORMING A COMPUTER CASING

BSTZ File No.: 004860.P2452 Atty/Secty Initials: JCS/EWK/sh
Date Mailed: May 31, 2000 Docket Due Date: ***

The following has been received in the U.S. Patent & Trademark Office on the date stamped hereon:

- ☐ Amendment/Response (____ pgs.)
- ☐ Appeal Brief (____ pgs.) (in triplicate)
- ☒ Application - Utility (15 pgs., with cover and abstract)
- ☐ Application - Rule 1.53(b) Continuation (____ pgs.)
- ☐ Application - Rule 1.53(b) Divisional (____ pgs.)
- ☐ Application - Rule 1.53(b) CIP (____ pgs.)
- ☐ Application - Rule 1.53(d) CPA Transmittal (____ pgs.)
- ☐ Application - Design (____ pgs.)
- ☐ Application - PCT (____ pgs.)
- ☐ Application - Provisional (____ pgs.)
- ☒ Assignment and Cover Sheet (5 pgs.)
- ☒ Certificate of Mailing (Express Mail)
- ☒ Declaration & POA (4 pgs.) (Signed)
- ☐ Disclosure Docs & Orig & Copy of Inventors Signed Letter (____ pgs)
- ☒ Drawings: 2 # of sheets includes 2 figures

- ☒ Express Mail No.: EL431888635US ☒ Check No. 35587
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- ☐ Information Disclosure Statement & PTO-1449 (__ pgs.) ☐ Check No. _____
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- ☐ Preliminary Amendment (____ pgs.)
- ☐ Reply Brief (____ pgs.)
- ☐ Response to Notice of Missing Parts
- ☐ Small Entity Declaration for Indep. Inventor/Small Business
- ☒ Transmittal Letter, in duplicate (2 pgs.)
- ☒ Fee Transmittal, in duplicate (2 pgs.)

☐ Other: _____

UNITED STATES PATENT APPLICATION

FOR

METHOD OF FORMING A COMPUTER CASING

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Sheena Hicks
(Typed or printed name of person mailing paper or fee)
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(Signature of person mailing paper or fee)
5-31-2000
(Date signed)

FIELD OF THE INVENTION

The present invention relates to a method of forming a computer casing.

BACKGROUND

Rubber molded over plastic has been known for some time. Recently, translucent plastic pieces having translucent rubber overmoldings have been introduced. The combination of translucent plastic and translucent rubber revealed a previously unrecognized problem. The rubber and plastic do not form a stable interface. The rubber appears to attack the plastic, resulting in cracks and opaque patches appearing in the plastic underneath the rubber overmolding. Such cracks affect the structural integrity of the plastic piece, and the opaque patches are aesthetically unpleasing.

SUMMARY OF THE INVENTION

The present invention provides a method of forming a rubber-overmolded casing that involves applying a protective barrier to at least a part of a plastic piece that is part of the casing and then molding a rubber layer onto at least the part of the plastic piece over the protective barrier. In one embodiment, a polyurethane coating provides a protective barrier between a polycarbonate plastic piece and a rubber layer that prevents the rubber layer from attacking the underlying polycarbonate plastic piece.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a flowchart illustrating one embodiment of a method according to the present invention.

Figure 2 is a flowchart illustrating another embodiment of a method according to the present invention.

DETAILED DESCRIPTION

The present invention provides a method of protecting a plastic piece from being attacked by a rubber overmolding. The present invention will be described below in connection with the Figures and with certain embodiments. In the following description, specific details are set forth to provide a thorough understanding of the present invention, however, those of ordinary skill in the art will appreciate that the present invention may be practiced without these specific details. In other instances, details of well-known steps, structures and techniques have been omitted to avoid obscuring the present invention.

The present invention provides a protective barrier between a plastic piece and a rubber layer overmolded onto the plastic piece. While the present invention may be applied to any rubber layer overmolded onto any plastic piece, the present invention is particularly useful for translucent plastic pieces with translucent rubber overmoldings. Translucent polycarbonate pieces with translucent rubber overmoldings include computer casings such as those incorporated into iBook® portable computers available from Apple Computer, Inc.®.

In a typical rubber overmolding process, a plastic piece is first provided. The plastic piece may be formed by injection molding or other methods know in the art for forming plastic pieces. In injection molding, for example, a plastic resin is melted, and the melted plastic is introduced, or injected, into the mold to be formed into a shape determined by the mold. After the plastic piece has been formed, the plastic piece is placed into a second mold. A melted rubber is introduced into the second mold, and a rubber layer molded over at least a part of the plastic piece in a shape determined by the second mold.

Figure 1 illustrates one embodiment of a method according to the present invention. Methods according to present invention begin at step **100** by providing a

plastic piece **110**. The plastic piece, for example, may be a part of a computer casing, or a part of a casing for a computer peripheral, such as a computer keyboard, printer, mouse, scanner, etc.. The plastic piece may be made of a polymer resin, such as a polycarbonate resin, a polycarbonate-polyester co-polymer resin, a co-polyester resin, or an ABS (acrylonitrile butadiene styrene) resin. In one embodiment, the plastic piece is translucent. The plastic piece is formed before the methods of the present invention begin, and may be formed by injection molding or other techniques known in the art. The plastic piece typically is allowed to cool down and equilibrate to ambient conditions after being formed.

A protective barrier is then applied to at least a part of the plastic piece in a step **120**. The protective barrier according to the present invention typically is applied as a liquid by spraying, brushing, rolling, dipping, etc., or by other techniques known in the art, and typically under ambient conditions. As the liquid dries, the protective barrier solidifies on and adheres to at least the part of the plastic piece. In one embodiment, the protective barrier is a polyurethane coating.

After the protective barrier is applied to at least the part of the plastic piece, a rubber layer is molded onto at least the part of the plastic piece over the protective barrier at step **130**. The rubber layer may be made of a polyester rubber, a polyether rubber, or other type of rubber known in the art. In one embodiment, the rubber layer is made of a translucent rubber. In another embodiment, where the rubber layer is made of a translucent rubber, the protective barrier is clear, and so not visible after the rubber layer is molded over at least the part of the plastic piece.

Figure 2 illustrates another embodiment of a method according to the present invention in which a polyurethane coating provides the protective barrier. As with the embodiment described above, the present embodiment begins at **200** by providing a plastic piece at step **210**. In one embodiment, the plastic piece is made of a polycarbonate resin. As described previously, the plastic piece may be formed

by injection molding or other techniques known in the art, and typically is allowed to equilibrate to ambient conditions after being formed.

In this embodiment, at least a part of the plastic piece on which the protective barrier will be applied is cleaned at step **220**. Dirt, oils, dust and other contaminants that may prevent the protective barrier from adhering to the plastic piece are removed in this step. The part of the plastic piece may be cleaned using a solvent, such as isopropyl alcohol, ethanol, methanol, etc., or other type of cleaner.

The plastic piece is dried at step **230** before the protective coating is applied. Drying removes any residual solvent or cleaner from the plastic piece that may prevent the protective barrier from adhering to the plastic piece. The plastic piece may be dried using compressed air, using heat, such as in an oven, or by other ways known in the art.

After the plastic piece has been cleaned and dried, the protective barrier made of a polyurethane coating is applied to at least the part of the plastic piece at step **240**. Polyurethane coatings may be applied as a liquid solution made up of two components, an isocyanate component and a polyol component. When the two components are combined, they react, and the liquid solution begins to dry, or solidify, into a polyurethane. While the solution is liquid, it can be applied to and coated on at least the part of the plastic piece. The liquid solution on at least the part of the plastic piece dries and solidifies to form the polyurethane coating.

Typically, the polyol component is added to the isocyanate component. In one embodiment, the isocyanate component and the polyol component are combined in a ratio of between about 45:55 and about 55:45, either by weight or by volume, to form the liquid solution. In another embodiment, the liquid solution is made up of approximately equal parts, *i.e.*, a ratio of about 50:50, either by weight or by volume, of the isocyanate component and the polyol component.

The polyurethane coating may be applied to at least the part of the plastic piece by spraying, brushing, rolling, dipping, etc., or by other techniques known in the art, and typically is applied under ambient conditions. In one embodiment, the polyurethane coating is applied at a temperature between about 20° and about 30°C. In another embodiment, the polyurethane coating is applied under a relative humidity of less than about 80%.

The polyurethane coating typically is made of an aliphatic polyurethane. In one embodiment, the polyurethane coating is made of an elastomeric polyurethane. In another embodiment, the polyurethane coating is clear.

After being applied to at least the part of the plastic piece, the polyurethane coating is cured, or solidified, **250** before a rubber layer is molded over the polyurethane coating **260**. If the polyurethane coating is not completely cured before the rubber layer is molded over it, it may become dislodged or torn as the melted rubber is introduced into the mold and flowed over it. In one embodiment, the polyurethane coating is cured at an elevated temperature higher than the ambient temperature. In another embodiment, the polyurethane coating is cured in an oven at a temperature between about 70°C and about 90°C. In still another embodiment, the polyurethane coating is cured in an oven at progressively higher temperatures. Curing of the polyurethane coating at an elevated temperature typically takes between about 20 minutes and about 60 minutes.

The protective barrier has a thickness sufficient to protect the plastic piece from being attacked by the rubber layer, but is not so thick as to be dislodged from the plastic piece as the rubber is being molded onto the part of the plastic piece. In one embodiment where the protective barrier is a polyurethane coating, the polyurethane coating has a thickness of between about 0.01 mm and about 0.03 mm. In another embodiment, the polyurethane coating has a thickness of 0.02 ± 0.005 mm.

The methods of the present invention produce plastic pieces with rubber overmoldings that do not attack the underlying plastic piece. The present invention thus provides rubber overmolded plastic pieces with enhanced stability. Where the plastic piece is made of a translucent polymer resin and the rubber layer made of a translucent rubber, the resulting article of manufacture does not form cracks or opaque patches and the aesthetic appearance of the article is maintained over time.

The methods of the present invention have been described with reference to certain embodiments. Those of ordinary skill in the art will recognize that numerous variations, modifications, and improvements can be made to the embodiments described above. The scope of the present invention is not limited to the above embodiments, but is defined by the claims that follow.

CLAIMS

What is claimed is:

1. A method of forming a rubber-overmolded plastic casing, the method comprising:

providing a plastic piece, the plastic piece being a part of a casing;

applying a protective barrier to at least a part of the plastic piece; and

molding a rubber layer onto at least the part of the plastic piece over the protective barrier.

2. The method as described in claim 1, wherein the plastic piece comprises a polycarbonate resin.

3. The method as described in claim 1, further comprising, before applying the protective barrier, cleaning at least the part of the plastic piece over which the protective barrier will be applied.

4. The method as described in claim 3 further comprising, after cleaning the part of the plastic piece and before applying the protective barrier, drying the plastic piece.

5. The method as described in claim 1, wherein the plastic piece is translucent.

6. The method as described in claim 1, wherein the casing is a computer casing.

7. The method as described in claim 1, wherein the casing is for a computer peripheral.

8. The method as described in claim 1, wherein the protective coating is applied as a liquid.

9. The method as described in claim 1, wherein the protective coating is applied under ambient conditions.

10. The method as described in claim 1, wherein the protective barrier is thick enough to prevent the rubber layer from attacking the plastic piece.

11. The method as described in claim 1, wherein the protective barrier is clear.

12. The method as described in claim 1, further comprising, before molding the rubber layer over the protective barrier, curing the protective barrier.

13. The method as described in claim 1, wherein the protective barrier is a polyurethane coating.

14. The method as described in claim 1, wherein the rubber layer is translucent.

15. A method of protecting a plastic piece from reacting with a rubber layer molded over at least a part of the plastic piece, the method comprising:

providing the plastic piece;

cleaning at least the part of the plastic piece;

drying the plastic piece;

after cleaning and drying the plastic piece, applying a liquid solution to at least the part of the plastic piece;

curing the liquid solution to form a polyurethane coating on at least the part of the plastic piece; and

molding the rubber layer onto at least the part of the plastic piece over the polyurethane coating.

16. The method as described in claim 15, wherein the plastic piece comprises a polycarbonate resin.

17. The method as described in claim 15 wherein at least the part of the plastic piece is cleaned using a solvent.

18. The method as described in claim 17 wherein the solvent is selected from the group consisting of: isopropyl alcohol, ethanol, and methanol.

19. The method as described in claim 15 wherein at least the part of the plastic piece is cleaned using a cleaner.

20. The method as described in claim 15 wherein the plastic piece is dried using compressed air.

21. The method as described in claim 15 wherein the plastic piece is dried in an oven.

22. The method as described in claim 15 wherein the plastic piece is translucent.

23. The method as described in claim 15 wherein the plastic piece is a part of a computer casing.

24. The method as described in claim 15 wherein the plastic piece is a part of a casing for a computer peripheral.

25. The method as described in claim 15 wherein the liquid solution comprises an isocyanate component and a polyol component.

26. The method as described in claim 25 wherein the liquid solution comprises approximately equal parts of the isocyanate component and the polyol component.

27. The method as described in claim 25 wherein the isocyanate component and the polyol component are present in the liquid solution in a ratio of between about 45:55 and about 55:45.

28. The method as described in claim 15 wherein the liquid solution is applied under ambient conditions.

29. The method as described in claim 15 wherein the liquid solution is applied at a temperature between about 20° and about 30°C.

30. The method as described in claim 15 wherein the liquid solution is applied under less than about 80% relative humidity.

31. The method as described in claim 15 wherein the polyurethane coating has a thickness of between about 0.01 and about 0.03 mm.

32. The method as described in claim 15 wherein the polyurethane coating has a thickness of 0.02 ± 0.005 mm.

33. The method as described in claim 15 wherein the polyurethane coating is clear.

34. The method as described in claim 15 wherein the liquid solution is cured at an elevated temperature.

35. The method as described in claim 15 wherein the liquid solution is cured at a temperature between about 70° and about 90°C.

36. The method as described in claim 15 wherein the liquid solution is cured at an elevated temperature for between about 20 and about 60 minutes.

37. The method as described in claim 15 wherein the rubber layer is translucent.

ABSTRACT OF THE DISCLOSURE

A method of providing a protective barrier between a plastic casing and a rubber layer molded over the plastic casing. The protective barrier is applied to the plastic casing and then the rubber layer molded onto the plastic casing over the protective barrier. The protective barrier prevents the rubber layer from reacting with the underlying plastic casing. In one embodiment, the plastic casing comprises a polycarbonate resin and the protective barrier comprises a polyurethane coating.

FIGURE 1

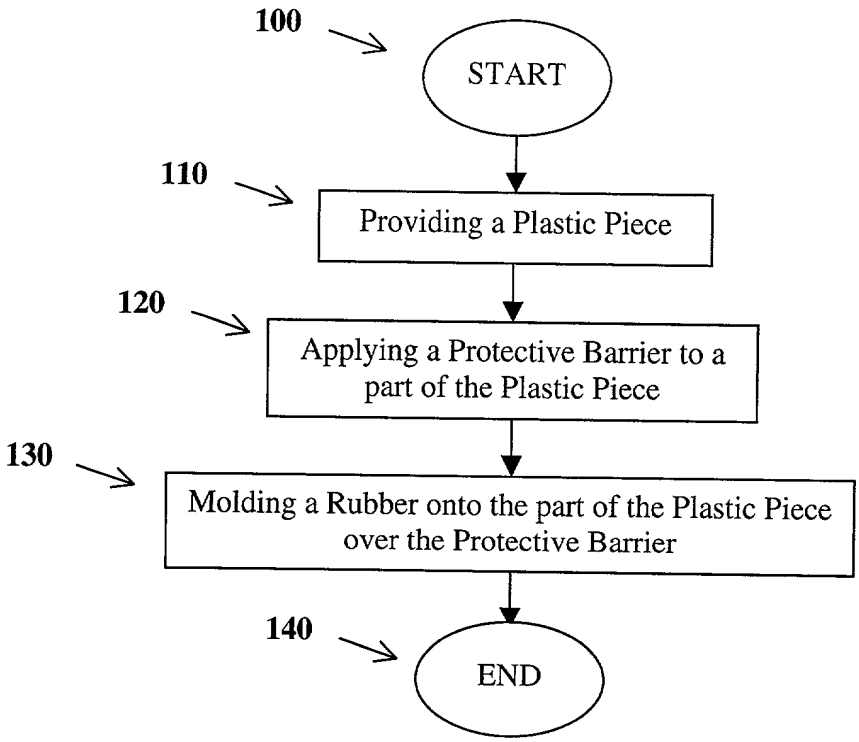
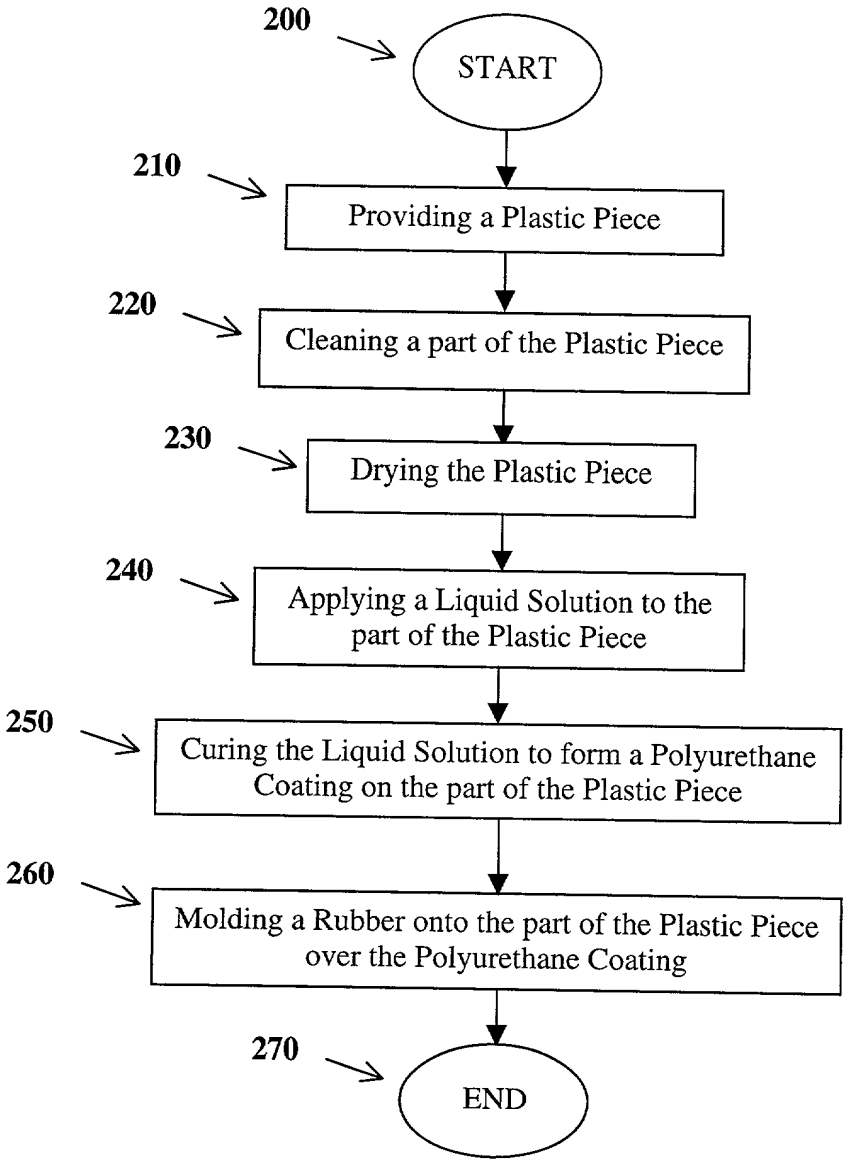


FIGURE 2



Case / Docket No.: **P2452** PATENT

DECLARATION AND POWER OF ATTORNEY FOR **UTILITY** PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Method of Forming a Computer Casing

the specification of which

_X_ is attached hereto.
___ was filed on_____ as
Application Serial No.
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I do not know and do not believe that the same was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and said invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) or Section 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status -- patented, pending, abandoned)

I hereby appoint as my attorneys, Mark Aaker, Reg. No. 32,667; Albert P. Cefalo, Reg. No. 27,315; Richard Liu, Reg. No. 34,377; Edward W. Scott, IV, Reg. No. 36,000; Nancy R. Simon, Reg. No. 36,930; and Helene Plotka Workman, Reg. No. 35,981; of **APPLE COMPUTER, INC., located at 1 Infinite Loop, M/S: 38-PAT, Cupertino, California 95014, telephone (408) 974-9453, facsimile (408) 974-5436,** with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) or Section 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status -- patented, pending, abandoned)

I hereby appoint as my attorneys, Mark Aaker, Reg. No. 32,667; Albert P. Cefalo, Reg. No. 27, 315; Richard Liu, Reg. No. 34,377; Edward W. Scott, IV, Reg. No. 36,000; Nancy R. Simon, Reg. No. 36,930; and Helene Plotka Workman, Reg. No. 35,981; of **APPLE COMPUTER, INC., located at 1 Infinite Loop, M/S: 38-PAT, Cupertino, California 95014, telephone (408) 974-3032, facsimile (408) 974-5436,** with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Full Name of Third/Joint Inventor: Paul Choiniere

Inventor's Signature Paul Choiniere Date 5/3/00

Residence: 3727 Fillmore Street #204, San Francisco, CA 94123 Citizenship: USA

Post Office Address: Same